

## **DETAILED ACTION**

### ***Status of Application***

1. In the response filed July 2<sup>nd</sup>, 2008, Applicant elected the invention of Group II, claims 30-59, with traverse, and canceled claims 60-73. The traversal is made on the grounds that the invention of Group I, claims 1-29, is drawn to a process which the apparatus of Group II is specifically designed to carry out. The traversal is found persuasive thus the restriction between the inventions of Group I and II, claims 1-59, is withdrawn.
2. It is noted that Applicant failed to respond to the election of species requirement made in the prior action, however this requirement is hereby withdrawn in light of the art of record.
3. Claims 1-59 are pending in the application and are presented for examination.

### ***Claim Objections***

4. Claims 34 and 49 are objected to for claiming "The method of claim..." whereas both depend from apparatus claims.

### ***Claim Rejections - 35 USC § 112***

5. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

6. Claims 4, 11 and 39 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.
7. Claim 4 is objected to for claiming a method comprising "presenting at least one additional evaporant source...if desired" when neither the present claim nor its parent claims require presenting an evaporant source. There is insufficient antecedent basis for the term "evaporant source".
8. The term "low energy beam" in claims 11 and 39 is a relative term which renders the claim indefinite. The term "low energy beam" is not defined by the claim, the specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention. The level of energy of an energetic beam can vary widely and have significantly different outcomes when applied as in the present claim, the claim is rendered indefinite.

***Claim Rejections - 35 USC § 102***

9. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

10. Claims 1-2, 15-16, 25-26, and 29 are rejected under 35 U.S.C. 102(b) as being anticipated by Rigney et al, US 6,153,313.

Regarding claims 1, 15, and 25, Rigney teaches methods of forming thermal barrier coating systems on substrates (turbine engine parts, Abstract) by first depositing intermetallic material bond coats, such as intermetallics alloyed with Ti or Ta (Abstract), over which is deposited a thermal layer such as a zirconia oxide (Column 5 lines 1-17).

Regarding claims 2, 16, and 26, Rigney teaches that electron beam physical vapor deposition is used for the deposition of the layers (Column 1 lines 47-52, Column 5 lines 20-25).

Regarding claim 29, the intermetallic taught is an NiAl compound (Abstract).

11. Claims 12-13, 19, 21-22, and 24 are rejected under 35 U.S.C. 102(b) as being anticipated by Grassi, US 5,236,787.

Regarding claims 12 and 21, Grassi teaches methods of forming thermal barrier coating systems on substrates by first depositing metallic material bond coats, such as Zr alloys or stainless steel (metallic coats listed in table, Column 3), over which is deposited a thermal-insulating layer such as a ZrC (ceramic materials listed in table, Column 4).

Regarding claims 13 and 22, Grassi teaches the plasma spray deposition of both layers (Column 3 lines 44-46, Column 4 lines 12-13).

Regarding claim 19, Grassi teaches the use of transition/intermediate layers between the bond coat and thermal layer (Abstract).

Regarding claim 24, ZrC may be used as the thermal-insulating layer (ceramic materials listed in table, Column 4).

12. Claims 30-34, 37-59 are rejected under 35 U.S.C. 102(b), as being anticipated by Wadley et al, US Patent 5,534,314.

Regarding claims 30, 40, 44, 51, and 56, applicant appears to be invoking claim interpretation under the 6th paragraph of U.S.C. 112. The present claims recite a "means for" followed by the functional language "depositing" but contain no structure to achieve this function. See three prong analysis, MPEP 2181 [R6]. As such the structure required for performing the function of the deposition is being interpreted from the specification to be the directed vapor deposition apparatus discussed on page 4, lines 7-19, and illustrated in Figure 2. Wadley teaches a deposition apparatus with a deposition chamber housing for a substrate (Abstract). Wadley teaches the use of directed vapor deposition as the deposition means (Column 1 lines 10-15). This deposition means is taught to be useful for the deposition of multilayered thermal barrier coatings (column 8 lines 10-15) by efficiently depositing metal and ceramic vapors (Column 7 lines 64-67). Wadley specifically teaches the deposition of Ti, Zr, Nb (Table 1 Column 10), oxides, and carbides (Column 6 lines 15-23), but teaches that compounds, alloys, and "virtually the entire periodic table of elements in all possible combinations" can be evaporated and deposited using the apparatus (Column 3 lines 21-27). The structural elements thus meet the requirements under the sixth paragraph of 112 and read on the present claims.

Regarding claims 31-32, 41-42, 45-46, 52-53, and 57-58, Wadley teaches the use of directed vapor deposition as the deposition means (Column 1 lines 10-15).

Regarding claims 33-34, 43, 50, 55, and 59, Wadley teaches the use of pressures ranging from 0.001 Torr to atmospheric pressure (equivalent to 0.1 Pa up to 101 kPa) and a carrier gas stream to deposit an evaporant source which is generated by an electron beam gun (energetic beam), the apparatus functioning as presently claimed (Abstract).

Regarding claim 37-39, Wadley teaches the use of a nozzle assembly which comprises a nozzle, carrier gas conduit (i.e. nozzle gap from which the carrier gas flows, see Column 6 lines 60-64), and crucible for retaining the evaporant source (Column 10 lines 27-33). The assembly is used to generate the evaporant inside the nozzle gap/conduit and thus the crucible is at least substantially surrounded by the gap/conduit (Column 6 lines 60-64).

Regarding claims 47-49, and 54, the apparatus of Wadley is a means for depositing multilayered coatings of reactive materials, such as metals and carbides including tantalum and titanium alloys, and thus provide for the deposition of TaC layers and intermediate layers of Ti (Column 3 lines 21-37).

***Claim Rejections - 35 USC § 103***

13. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

14. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

15. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

16. Claims 3-5, 9-11, 17, and 27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Rigney et al, US 6,153,313, as applied to claims 1, 15, and 25 above, in view of Wadley et al, US Patent 5,534,314.

Regarding claims 3-5, 9-10, 17, and 27, Rigney teaches the method substantially as claimed but fails to teach the use of a directed vapor deposition technique with the claimed parameters. While Rigney teaches the use of PVD or EBPVD, Wadley teaches the use of directed vapor deposition as an equivalent method to overcome drawbacks of methods such as PVD and EBPVD (Column 1 lines 21-66). It would have been obvious

to those of ordinary skill in the art at the time of the invention to utilize the DVD process of Wadley in lieu of PVD or EBPVD in the method of Rigney in order to efficiently produce advanced materials within one apparatus.

Regarding claim 11, Wadley teaches the use of ion-assisted deposition which uses a substrate bias system to deposit the generated ions (Column 13 lines 44-60). The energy of the system can be decreased or increased as required.

17. Claims 6-8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Rigney in view of Wadley as applied to claim 4 above, and further in view of Schiller et al, USPN 5,635,087.

As discussed above, Rigney/Wadley teach the method substantially as claimed but fail to teach the use of a hollow cathode arc plasma activation source to regulate the deposition as presently claimed. Schiller teaches the use of a hollow cathode arc source in the immediate vicinity of a substrate to direct the deposition of vapors (Abstract). The use of the hollow cathode arc combined with the electron beam evaporation allows for the deposition at high rates (Column 2 lines 46-51). It would have been obvious to those of ordinary skill in the art at the time of the invention that the hollow cathode arc plasma assisted deposition of Schiller could be used to direct deposition of the evaporant of Rigney/Wadley. One would have been motivated to combine the teachings of these references and arrive at the present invention in order to provide the high deposition rates as taught by Schiller.

18. Claim 28 is rejected under 35 U.S.C. 103(a) as being unpatentable over Rigney et al, US 6,153,313, as applied to claim 25 above, in view of Grassi, USPN 5,236,787.

As discussed in paragraph 10 above, Rigney teaches the method substantially as claimed but fails to teach the use of the presently claimed compounds or alloys as the thermal insulating layer. Grassi teaches the use of materials such as ZrC as thermal insulating materials to limit conduction of heat through the coating to a thermal diffusivity below  $0.005 \text{ cm}^2/\text{sec}$  (Column 4 lines 12-33). It would have been obvious to those of ordinary skill in the art at the time of the invention that the ceramic materials of Grassi could be used as thermal insulating layers, in lieu of those taught by Rigney. One would have been motivated to combine the teachings of these references and arrive at the present invention in order to provide the thermal insulation as taught by Grassi.

19. Claim 18 is rejected under 35 U.S.C. 103(a) as being unpatentable over Rigney et al, US 6,153,313, as applied to claim 15 above, in view of Rigney et al, EP1209321, henceforth Rigney/EP.

As discussed in paragraph 10 above, Rigney teaches the method substantially as claimed but fails to teach the use of TaC or its alloys as the thermal insulation. Rigney/EP teaches the use of carbide precipitates in thermal barrier coating systems to thermally stabilize the coating (Abstract and paragraph 0017). Thus, the Ta alloys of Rigney, when combined with the carbide participates of Rigney/EP, provide increased stability. It would have been obvious to those of ordinary skill in the art at the time of the invention that the Ta alloys of Rigney could be combined with the carbides of Rigney/EP to create a TaC thermal insulating layer. One would have been motivated to combine

the teachings of these references and arrive at the present invention in order to provide the stabilization as taught by Rigney/EP.

20. Claims 14 and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Grassi, USPN 5,236,787, as applied to claims 12 and 21 above, in view of Wadley et al, US Patent 5,534,314.

Regarding claims 14 and 23, as discussed in paragraph 11 above, Grassi teaches the method substantially as claimed but fails to teach the use of directed vapor deposition of the coating layers. While Grassi teaches the use of plasma spray deposition, Wadley teaches the use of directed vapor deposition as an equivalent method to overcome drawbacks of other plasma methods (Column 1 lines 21-66). As discussed in paragraph 12 above, Wadley teaches the use of DVD to efficiently deposit thermal barrier coating systems. It would have been obvious to those of ordinary skill in the art at the time of the invention that the DVD process of Wadley could be used in lieu of plasma spray to manufacture the coating systems of Grassi. One would have been motivated to combine the teachings of these references and arrive at the present invention in order to efficiently produce advanced materials within one apparatus.

21. Claim 20 is rejected under 35 U.S.C. 103(a) as being unpatentable over Grassi, US 5,236,787, as applied to claim 19 above, in view of Rigney et al, USPN 6,153,313.

As discussed in paragraph 11 above, Grassi teaches the use of transition (i.e. intermediate) layers between the bond coat and thermal layer (Abstract) but fails to teach the use of Ti or its alloys. Rigney teaches the use of Ti alloys to provide coatings with enhanced performance such as increased creep strength (Abstract). It would have

been obvious to those of ordinary skill in the art at the time of the invention that the Ti alloys of Rigney could be used in the coating system and thus the intermediate layers of Grassi. One would have been motivated to combine the teachings of these references and arrive at the present invention in order to provide the enhanced performance as taught by Rigney.

22. Claims 35-36 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wadley et al, US Patent 5,534,314, as applied to claim 33 above, in view of Schiller et al, USPN 5,635,087.

Regarding claim 35, as discussed in paragraph 12 above, Wadley teaches the method substantially as claimed but fails to teach the use of a substrate bias system and hollow cathode arc plasma activation source to perform the deposition as presently claimed. Schiller teaches the use of a hollow cathode arc source in the immediate vicinity of a substrate to ionize and direct the deposition of vapors (Abstract). The use of the hollow cathode arc combined with the electron beam evaporation allows for the deposition at high rates (Column 2 lines 46-51). It would have been obvious to those of ordinary skill in the art at the time of the invention that the hollow cathode arc plasma assisted deposition of Schiller could be used to direct deposition of the evaporant of Wadley. One would have been motivated to combine the teachings of these references and arrive at the present invention in order to provide the high deposition rates as taught by Schiller.

Regarding claim 36, the hollow cathode arc source of Schiller comprises several juxtaposed cathode orifices opposite anodes with the gas and vapor stream running between (Fig 1 and Column 4, lines 20-32).

### ***Double Patenting***

23. A rejection based on double patenting of the "same invention" type finds its support in the language of 35 U.S.C. 101 which states that "whoever invents or discovers any new and useful process ... may obtain a patent therefor ..." (Emphasis added). Thus, the term "same invention," in this context, means an invention drawn to identical subject matter. See *Miller v. Eagle Mfg. Co.*, 151 U.S. 186 (1894); *In re Ockert*, 245 F.2d 467, 114 USPQ 330 (CCPA 1957); and *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970).

A statutory type (35 U.S.C. 101) double patenting rejection can be overcome by canceling or amending the conflicting claims so they are no longer coextensive in scope. The filing of a terminal disclaimer cannot overcome a double patenting rejection based upon 35 U.S.C. 101.

24. Claims 30-38 are provisionally rejected under 35 U.S.C. 101 as claiming the same invention as that of claims 30-32 and 35-40 of copending Application No.

10/533993. This is a provisional double patenting rejection since the conflicting claims have not in fact been patented.

25. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory obviousness-type double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent either is shown to be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement.

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

26. Claims 1-11 are provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 3-13 of copending Application No. 10/533993 in view of Rigney et al, US 6,153,313. The copending application claims require only a bond coat, whereas the present claims require a Ti or Ti alloy bond coat. However, Rigney teaches that it was well known in the art at the time of the invention to combine bond coats with Ti alloys to improve the performance of the resulting coatings (Abstract).

This is a provisional obviousness-type double patenting rejection.

### **Conclusion**

27. Claims 1-59 remain pending in the application and are rejected.

28. Any inquiry concerning this communication or earlier communications from the examiner should be directed to ERIN EVANS whose telephone number is (571)270-5354. The examiner can normally be reached on Monday thru Friday, 7am to 4pm EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael Kornakov can be reached on 571-272-1303. The fax phone

number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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Examiner, Art Unit 1792

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